UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/734,328	12/12/2003	Mohammed Shaarawi	200309536-1	1352

22879 7590 05/10/2007

HEWLETT PACKARD COMPANY
P O BOX 272400, 3404 E. HARMONY ROAD
INTELLECTUAL PROPERTY ADMINISTRATION
FORT COLLINS, CO 80527-2400

EXAMINER	
RAYMOND, BRITTANY L	
ART UNIT	**PAPER NUMBER**
1756	

MAIL DATE	DELIVERY MODE
05/10/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/734,328	SHAARAWI ET AL.	
	Examiner	Art Unit	
	Brittany Raymond	1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 February 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 and 3-52* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 and 3-52* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *12 December 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

2. Claims 1, 4, 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cauchi (U.S. Patent Publication 2003/0113674) in view of Tashiro (U.S. Patent Publication 2004/0257506).

Cauchi ('674) discloses a process for forming a resist pattern, which includes exposing the wafer through a first mask with a first dose of energy, baking the wafer, exposing the wafer through a second mask with a second dose of energy and baking again (Table 1, Paragraph 0020). Cauchi ('674) states in part (b) of claim 1, that the second dose of radiation is insufficient by itself to develop the pattern. It would be reasonable to infer that this means that the second dose of radiation is less than the first dose of radiation. Cauchi ('674) states that there is a baking step after the first

exposure and before the second exposure, as well as after the second exposure (Table 1, Paragraph 0020), as recited in claims 4 and 5 of the present invention. Cauchi ('674) also discloses that the first mask has a clear region and a non-clear region (Claim 1, Step (a)). Cauchi ('674) states that the second mask has a clear region, which is at a position of at least a portion of the non-clear region of the first mask (Claim 1, Step (b)). This creates three portions on the layer, one being completely exposed, one portion being partially exposed, and the other not being exposed at all, as recited in claim 6 of the present invention.

Cauchi ('674) fails to disclose that the baking step forms a depression at the surface of the layer in the first or second portion of the layer.

Tashiro discloses an embodiment for forming a liquid crystal display device comprising: forming a photosensitive resin on a substrate surface, prebaking the substrate, irradiating the photosensitive resin with ultraviolet light, and a first and second bake that are used to form projections and depressions in the photosensitive resin layer (Paragraph 0206), as recited in claim 1 of the present invention.

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have used the baking step to form the depression in the surface of the layer, as suggested by Tashiro, in the process of Cauchi ('674) because Tashiro teaches that baking can be used to form depressions with a specific tilt angle in a photosensitive layer.

3. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cauchi (U.S. Patent Publication 2003/0113674) in view of Tashiro (U.S. Patent Publication

2004/0257506) as applied to claims 1, 4, 5, and 6 above, and further in view of Cauchi (U.S. Patent Application 2004/0101790).

The teachings of Cauchi ('674) and Tashiro have been discussed in paragraph 2 above.

Cauchi ('674) and Tashiro fail to disclose that the baking occurs at a temperature in the range of 80-120 degrees Celsius.

Cauchi ('790) discloses a photoresist exposure process that has two exposures, each having a baking step afterwards (See Figure 2). Cauchi ('790) states that the baking takes place at between 110 and 140 degrees Celsius (Paragraph 0027), which is within the range recited in claim 3 of the present invention.

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have modified the processes of Cauchi ('674) and Tashiro by having the baking step take place at a temperature in the range of 110 to 140 degrees Celsius, as suggested by Cauchi ('790) because Cauchi ('790) teaches such temperature range leads to an improved pattern in a lithographic process using two exposures at different exposure doses.

4. Claims 11, 12, 16, 21, 22-26, 29, and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cauchi (U.S. Patent Publication 2003/0113674) in view of Tashiro (U.S. Patent Publication 2004/0257506) as applied to claims 1, 4, 5, and 6 above, and further in view of Tzu (U.S. Patent 6007324).

The teachings of Cauchi ('674) and Tashiro have been discussed in paragraph 2 above. The teachings of Cauchi ('674) describe what is being recited in claims 23

through 26 of the present invention. Cauchi ('674) also discloses that the photoresist can be negative (Claim 4), as recited in claim 30 of the present invention.

Cauchi ('674) and Tashiro fail to disclose a description of the three portions formed on the photoresist layer which includes the formation of a void, that the third portion is enclosed within the second portion, a description of the masks used in each exposure, and the order in which each exposure occurs and the mask used for each.

Tzu ('324) discloses a method of making a resist pattern comprising the steps of exposing a first pattern in the top and bottom portions of the layer and exposing a second pattern into the top portion of the layer with a second exposure dosage, wherein the first pattern lies within the second pattern and the first exposure dose is greater than the second exposure dose (Claim 1). Since the patterns overlap, this forms a third portion that is exposed twice. While Tzu ('324) does not teach if the photoresist is positive or negative, it is clear from the description in column 6, lines 37 to 41 and 64 to 67 and Figures 4 and 5, that the photoresist is positive. This means that this process would be the opposite of what is recited in claim 11 in the present invention. However, the developing process of Tzu ('324) forms the same pattern with a void extending through the layer in the third portion and a depression forming at the surface of the second portion, which encloses the void (See Figure 4), as stated in claim 12 of the present invention. Tzu ('324) shows that the pattern of the first mask has a non-transmissive portion, which corresponds to the first and second portions of the present invention, and a transmissive portion, which corresponds to the third portion of the present invention (Figures 3 and 4). Tzu ('324) also shows that the pattern of the

second mask has a non-transmissive portion, which corresponds to the first portion of the present invention, and a transmissive portion, which corresponds to the second and third portions of the present invention (Figures 3 and 4). The first and second masks are the opposite of what is claimed in the present invention because the photoresist of Tzu ('324) is positive, whereas the photoresist of the present invention is negative. If the photoresist of Tzu ('324) were negative, then the masks would match what is claimed in claim 16 of the present invention. Also, when the masks are exposed together, they have transmissive, partially transmissive and non-transmissive portions that expose the three different portions of the resist, as stated in claim 29 of the present invention. In the description of the invention, Tzu ('324) states that the first exposure occurs before the second exposure (Column 5, Lines 13-19), which is claimed in claim 21 of the present invention. Tzu ('324) also states that the exposure steps can be reversed, having the second exposure before the first exposure (Column 5, Line 48), as claimed in claim 22 of the present invention.

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have modified the methods of Cauchi ('674) and Tashiro and have described a specific process and types of masks used in the process, as suggested by Tzu ('324), because Tzu ('324) teaches that this process must be done in order to form a more specific pattern which is very similar to the one described in the present invention.

5. Claims 13-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cauchi (U.S. Patent Publication 2003/0113674) in view of Tashiro (U.S. Patent

Publication 2004/0257506) and Tzu (U.S. Patent 6007324) as applied to claims 11, 12, 16, 21, 22-26, 29, and 30 above, and further in view of Okoroanyanwu (U.S. Patent 6589713).

The teachings of Cauchi ('674), Tashiro, and Tzu ('324) have been discussed in paragraphs 2 and 4 above.

Cauchi ('674), Tashiro, and Tzu ('324) fail to disclose that the void's lower portion and the depression have substantially circular cross-sections, the circumference of the void's lower portion is within the circumference of the depression, the depression has a generally parabolic shape, and the void's lower portion and the depression are substantially concentric.

Okoroanyanwu discloses a process for forming vias wherein radiation is provided through a mask to form an aperture, which can be circular in shape (Column 4, Line 35), as recited in claim 13 of the present invention. A step of etching is performed after this to form a circular hole within the aperture (Column 5, Lines 35-40), also recited in claim 13 of the present invention. When formed, the aperture can have a parabolic shape (See Figure 4), as recited in claim 14, and it is concentric with the circular hole (See Figure 15), as recited in claim 15.

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have modified the methods of Cauchi ('674), Tashiro, and Tzu ('324) by making the depression and void circular in shape, such as a parabolic shape for the depression, with the void lying within the depression, as suggested by Okoroanyanwu, because the purpose of the invention is to produce a fluid emitter and

fluid is able to flow more easily through a shape with rounded edges. It would have also been obvious to have made the void and depression concentric, as suggested by Okoroanyanwu, because more fluid can be emitted at one time if the two have a common center.

6. Claims 27 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cauchi (U.S. Patent Publication 2003/0113674) in view of Tashiro (U.S. Patent Publication 2004/0257506) and Tzu (U.S. Patent 6007324) as applied to claims 11, 12, 16, 21, 22-26, 29, and 30 above, and further in view of Cauchi (U.S. Patent Application 2004/0101790).

The teachings of Cauchi ('674), Tashiro, and Tzu ('324) have been discussed in paragraphs 2 and 4 above.

Cauchi ('674), Tashiro, and Tzu ('324) fail to disclose that the layer is baked at 80-120 degrees Celsius and that it is baked for up to five minutes.

Cauchi ('790) discloses a photoresist exposure process that has two exposures, each having a baking step afterwards (See Figure 2). Cauchi ('790) states that the baking takes place for 90 seconds at between 110 and 140 degrees Celsius (Paragraph 0027), which are within the ranges recited in claims 27 and 28 of the present application.

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have modified the processes of Cauchi ('674), Tashiro, and Tzu ('324) by having the baking step last in the range of 90 seconds long at a temperature around 110 to 140 degrees Celsius, as suggested by Cauchi ('790),

because Cauchi ('790) teaches such temperature and time ranges lead to an improved pattern in a lithographic process using two exposures at different exposure doses.

7. Claims 31-36, 41-48, and 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cauchi (2003/0113674) in view of Tashiro (U.S. Patent Publication 2004/0257506), Tzu (U.S. Patent 6007324), Okoroanyanwu (U.S. Patent 6589713), and/or Cauchi (U.S. Patent Application 2004/0101790) as applied to claims 11-15, and 21-30 above, and further in view of Makigaki (U.S. Patent 6863375).

The teachings of Cauchi ('674), Tashiro, Tzu ('324), Okoroanyanwu, and Cauchi ('790) have been discussed in paragraphs 2 and 4-6 above.

Cauchi ('674), Tashiro, Tzu ('324), Okoroanyanwu, and Cauchi ('790) fail to disclose forming a nozzle and counter bore in the photoresist layer.

Makigaki discloses a silicon nozzle plate that has nozzles each with a first nozzle portion and a second nozzle portion that both have circular cross-sections. The circular cross-section of the first nozzle is smaller than the circular cross-section of the second nozzle portion (Claim 1). The first and second nozzle portions are formed by patterning a resist film, formed on a substrate (Claim 2). Makigaki also discloses that an ink supply hole, which is assumed to be similar to a counter bore, can be formed at the bottom of the nozzle (Column 6, Line 33).

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have modified the methods of Cauchi ('674), Tashiro, Tzu ('324), Okoroanyanwu, and Cauchi ('790) by further forming a nozzle and counter bore

in the layer, as suggested by Makigaki, because Makigaki teaches that it is known to make a fluid emitting nozzle photolithographically using photoresist films.

8. Claims 7-10, 17-20, 37-40, and 49-51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cauchi (U.S. Patent Application 2003/0113674), Tashiro (U.S. Patent Publication 2004/0257506), Tzu (U.S. Patent 6007324), Okoroanyanwu (U.S. Patent 6589713), and/or Cauchi (U.S. Patent Application 2004/0101790) as applied to claims, 1, 6, 11, 16, 31, and 36.

The teachings of Cauchi ('674), Tashiro, Tzu ('324), Okoroanyanwu, and Cauchi ('790) have been taught in paragraphs 2 and 4-7 above.

Cauchi ('674), Tashiro, Tzu ('324), Okoroanyanwu, and Cauchi ('790) fail to teach the range of doses recited in claims 7-10, 17-20, and 37-40. They also fail to teach the range of sizes recited in claims 49-51.

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have used the range of doses and range of sizes recited in the claims being rejected because the range of exposure doses depends on the photoresist being used and can be determined by one of ordinary skill in the art without undue experimentation to form the desired nozzle with the desired dimensions.

Response to Arguments

9. Applicant's election without traverse of claims 1-52 in the reply filed on 2/15/2007 is acknowledged.

10. Claims 53-54 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 2/15/2007.

11. Applicant's amendments have overcome the objections to paragraph 0035 of the specification and claim 31 that were presented in the last Office Action. Examiner has withdrawn the objections.

12. Applicant presents arguments in regards to Tzu (6093507) or Cauchi (2003/0113674) in view of Noritake (2002/0076845) over Claims 1-10. Tzu ('507) and Noritake have been removed from the art rejections and Applicant's arguments are now moot in view of the new ground(s) of rejection.

Applicant argues that claims 11-52 are patentable for the reasons presented for claim 1 and thus Applicant's arguments are now moot in view of the new ground(s) of rejection.

Conclusion

13. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brittany Raymond whose telephone number is 571-272-6545. The examiner can normally be reached on Monday through Friday, 8:00 a.m. - 4:30 p.m. EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

blr

KATHLEEN DUDA
PRIMARY EXAMINER